Announcements

- Homework for tomorrow…

  Ch. 32: Probs. 10, 13, & 14

  CQ1: a) not affected b) not affected (or weakly attracted)
  CQ4: out of page
  CQ5: down

- Office hours…

  MW 10-11 am
  TR 9-10 am
  F 12-1 pm

- Tutorial Learning Center (TLC) hours:

  MTWR 8-6 pm
  F 8-11 am, 2-5 pm
  Su 1-5 pm

Chapter 32

The Magnetic Field

(*The Magnetic Field of a Current*)

Review…

Biot-Savart Law…

$$\vec{B}_q = \frac{\mu_0}{4\pi}\frac{q\vec{v}\times\hat{r}}{r^2}$$

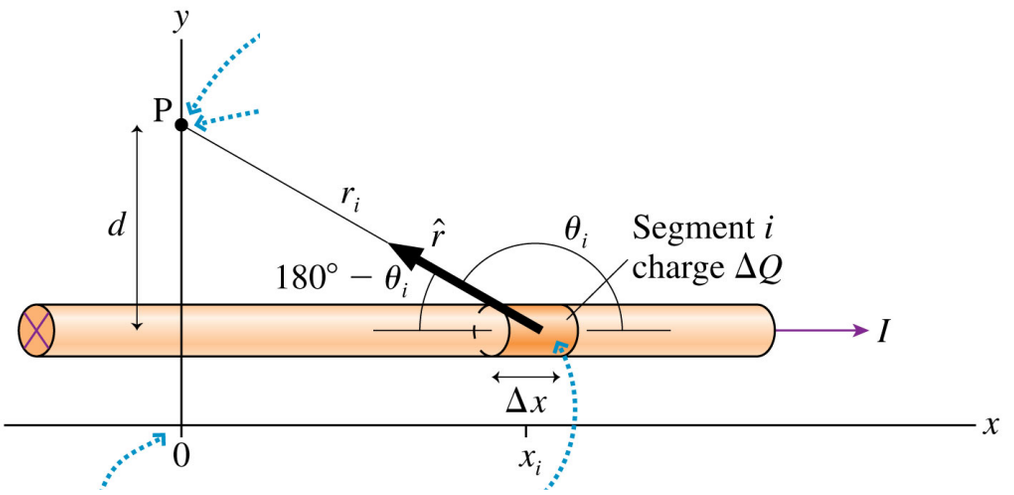
The *B*-field of a *short* segment of current is..

$$\vec{B}_{I\ seg} = \frac{\mu_0}{4\pi}\frac{I\Delta\vec{s}\times\hat{r}}{r^2}$$

i.e. 32.3:
The *B*-field of a long, straight wire

A long, straight wire carries current *I* in the positive *x*-direction.

Find the *B*-field of a point that is distance *d* from the wire.



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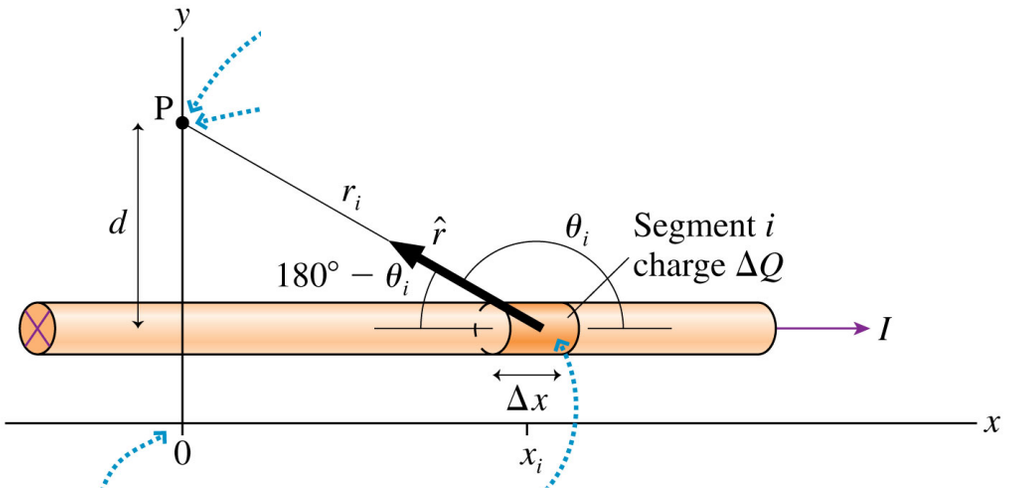
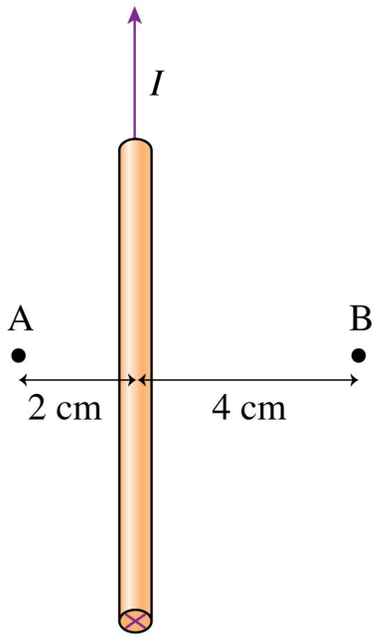


$$B_{wire} = \frac{\mu_0 I}{2\pi d}$$

Quiz Question 1

Compared to the magnetic field at point *A*, the magnetic field at point *B* is



1. Half as strong, same direction.
2. Half as strong, opposite direction.
3. One-quarter as strong, same direction.
4. One-quarter as strong, opposite direction.
5. Can't compare without knowing *I*.

i.e. 32.4:
The *B*-field strength near a heater wire

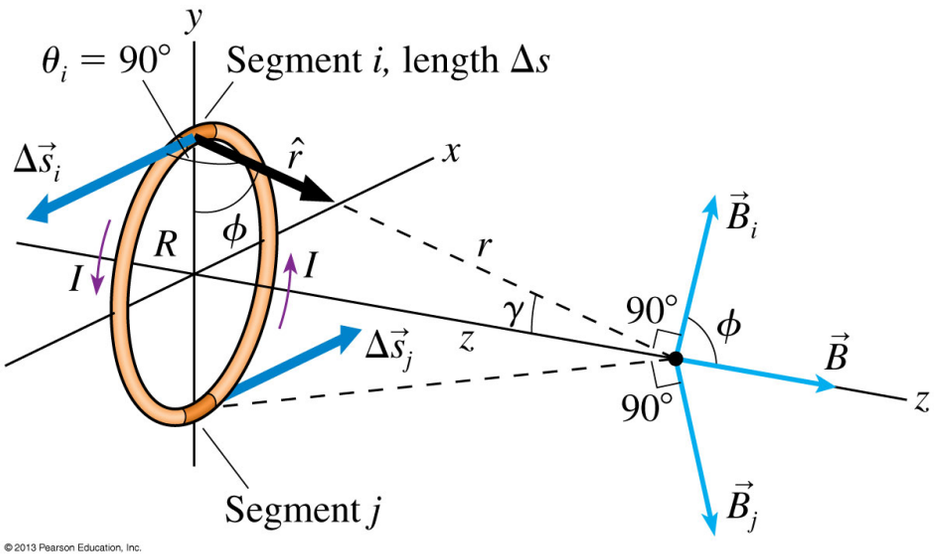
A 1.0 m long, 1.0 mm diameter nichrome heater wire is connected to a 12 V battery.

What is the *B*-field strength 1.0 cm away from the wire?

i.e. 32.5: The *B*-field of a current loop

The figure below shows a current loop, a circular loop of wire with radius R that carries current I.

Find the B-field of the current loop at distance z on the axis of the loop.



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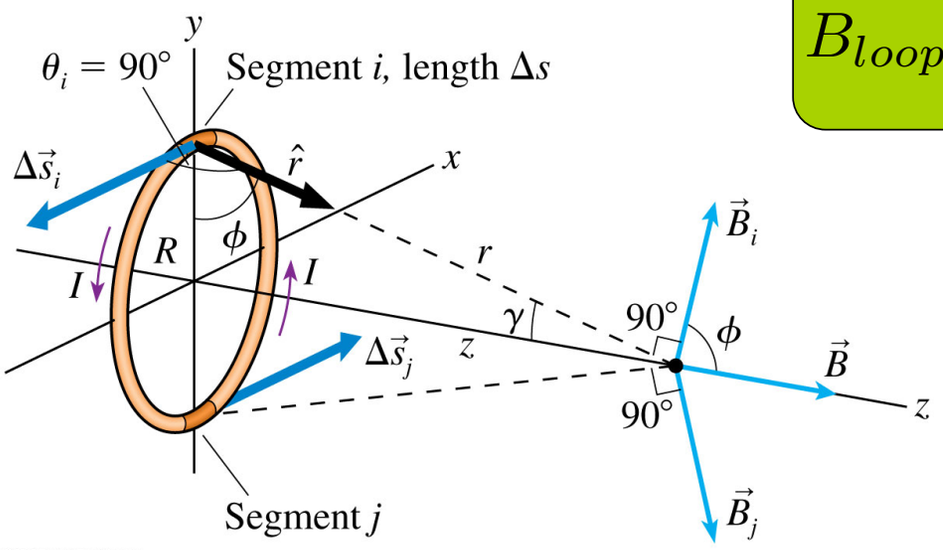
The figure below shows a current loop, a circular loop of wire with radius R that carries current I.

Find the B-field of the current loop at distance z on the axis of the loop.

$$B_{loop} = \frac{\mu_0}{2}\frac{IR^2}{(z^2+R^2)^{3/2}}$$



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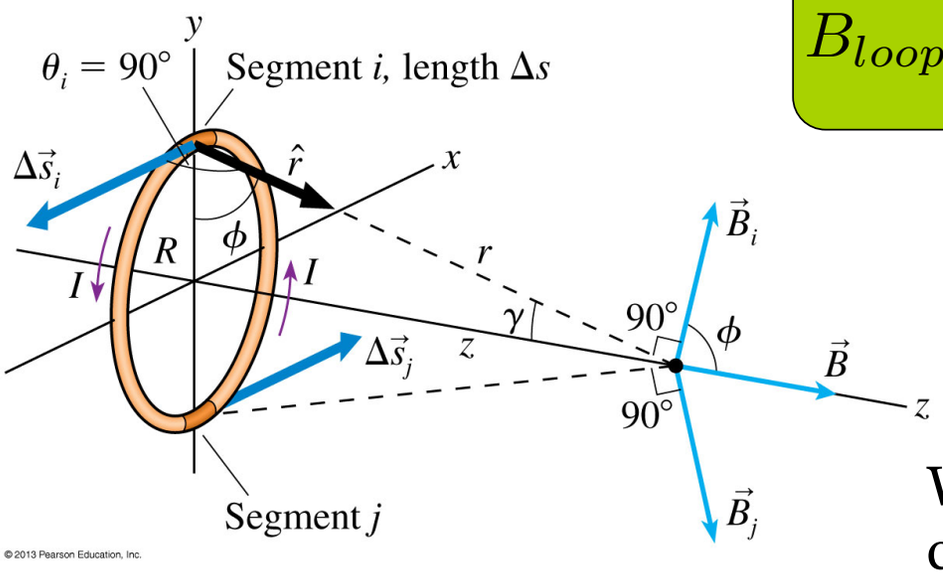
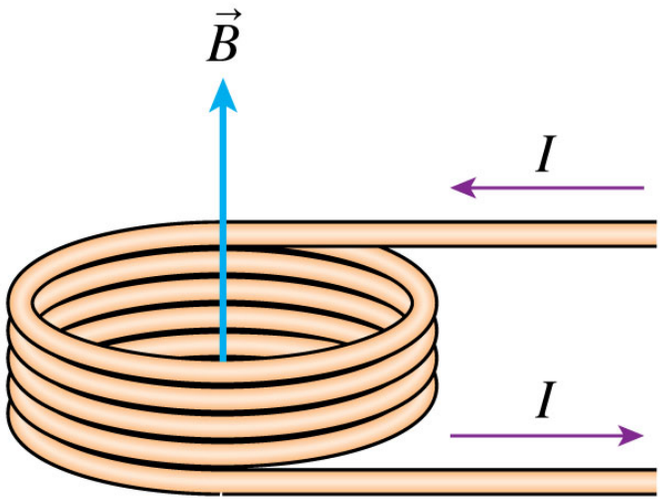


What's the *B*-field at the current loop's center?

The *B*-field of a…
coil consisting of *N* turns of wire…

$$B_{coil\ center} = \frac{\mu_0}{2}\frac{NI}{R}$$



Valid when the turns are all *very* close together,
so that the *B*-field of each is essentially the *same*.